prior to the implementation of RCRA. Consistent with these general practices, inventories of hazardous chemicals in radioactive waste were not required to be determined or documented before the application of RCRA to radioactive mixed waste at DOE facilities in late 1987. Wastes placed in the LLBGs before late 1987 have not been specifically characterized for hazardous chemical content, but they have been evaluated in the EIS alternatives relative to their radionuclide inventories. In addition, preliminary estimates of chemical inventories in this waste have been developed for analysis in the HSW EIS, and a summary of their potential impacts on groundwater has been added to Volume I Section 5.3 and Volume II Appendix G.

In addition, the October 23, 2003 Settlement Agreement contains proposed milestones in the M-91-03-01 Tri-Party Agreement Change Package for retrieval and characterization of suspect TRU waste retrievably stored in the Hanford LLBGs (United States of America and Ecology 2003). As part of that agreement, DOE will manage the retrievably stored LLBG waste under the following assumptions: (1) all retrievably stored suspect TRU waste in the LLBGs is potentially mixed waste; and (2) retrievably stored suspect TRU waste will be managed as mixed waste unless and until it is designated as non-mixed through the WAC 173-303 designation process.

Interactions among different types of waste that could potentially mobilize radionuclides have also been considered as part of the HSW EIS analysis. However, such interactions typically require specific chemical environments or large volumes of liquid as a mobilizing agent, neither of which are known to be present in the solid waste disposal facilities currently in use (see discussion in Volume II Appendix G). Possible effects of this type could be mitigated by selecting candidate disposal sites to avoid placing waste in locations where previous contamination exists.

Waste sites and residual soil contamination remaining at Hanford over the long term, and which are not specifically evaluated as part of the HSW EIS alternatives, have been evaluated previously as part of NEPA or CERCLA reviews. In those studies, the risks associated with older solid waste burials, tank waste residuals and leaks, and contaminated soil sites were found to be very small, even for alternatives that considered stabilization of the waste in place (DOE 1987, DOE and Ecology 1996, Bryce et al. 2002). Further evaluation of tank wastes is anticipated in the "Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site" (68 FR 1052). The cumulative groundwater impacts analysis in the HSW EIS also includes those wastes, as described in Volume I Section 5.14 and Volume II Appendix L.

DOE plans to characterize pre-1970 inactive burial grounds and contaminated soil sites, as well as the active LLBGs considered in the HSW EIS alternatives, under the RCRA past practice or CERCLA processes to determine whether further remedial action would be required before the facilities are closed. As part of that process, the long-term risks from these wastes would either be confirmed to be minimal, or the waste would be remediated by removal, stabilization, or other remedial actions to reduce its potential hazard. In all cases, the impacts from these previously disposed wastes would be the same for all alternative groups considered in the HSW EIS, and would not affect the comparisons of impacts among the alternatives or the decisions made regarding disposal of waste received in the future.

Comments

E-0044/002

The EIS risk analysis is based on the “Systems Assessment Capability” (SAC). This tool has never been tested, verified or validated and forms an inadequate and unproven basis upon which to build a risk assessment.

Contrary to the statements in the EIS, the SAC has no capability to assess uncertainty. It does possess a very limited capability to assess some potential estimation of the imprecision of the central tendency of the model.

To assess uncertainty, the analysis needs to estimate the likely potential range of errors. SAC does not do this.

SAC is based on a very crude and overly simplified one dimensional conceptual model of the vadose zone. This one dimensional purely vertical representation presumes that water flows downward uniformly through the entire volume of the soil. This is known to be false. Water and moisture flow in the subsurface at Hanford is known to follow preferential pathways.

These pathways are known to include:

Horizontal movement on the interfacial boundaries between soil layers. Hanford’s geology is dominated by the catastrophic ice age floods. These occurred roughly every 55 years over a period of about 1,500 years. Each flood laid down sediments that graded from course to fine during the deposition. As the floods receded, the area returned to desert conditions with plant growth and desert pedologic processes. These no doubt involved periodic fires resulting in hydrophobic surface formation. The resulting landforms were not uniformly flat. They including the undulations expected in any such deposition. The resulting surfaces are resistant to the vertical movement of water. Instead, they tend to drive water movement laterally and lead to sheet and channel flow.

Vertical movement on clastic dikes. As the Hanford study and atlas on clastic dikes shows, these floods also resulted in the formation of massive subsurface vertical clastic dikes and horizontal sills. These dikes are composed of dozens of layers of fine clay materials that both wick moisture and prevent the lateral movement of water, moisture and waste.

Combined, these features describe a radically different subsurface conceptual model from that used in SAC. They describe a subsurface dominated by horizontal transport in thin layers on surface boundaries to vertical walls formed by the clastic dikes. These result in the rapid transport of water and waste from the near surface to the groundwater, bypassing the bulk of the soil volume.

This has been repeatedly documented in Hanford historical documents. It was noted in the 1950’s in the 200 West area disposals west of Redox. In those disposals, the records even show that cesium and strontium at depth behaved differently depending on the type of waste they had been disposed in. These reports show deep migration of cesium, strontium, technetium, uranium and other radionuclides into the groundwater.

It has been documented in the 1960s and 1970s with tank leaks and gamma logs. Three Rivers Environmental analyzed these logs and clearly demonstrated the lateral movement of tank waste.

It is seen in the observation of the highest technetium levels ever found at Hanford in the groundwater near the SX tank farm as tank waste has moved across these surfaces, down a vertical surface (probably a dike) to the groundwater. SAC does not predict Technetium in the groundwater.

It is seen in the high uranium levels in groundwater in the 200 east area. SAC predicts no uranium in groundwater in the next 10,000 years in 200 east. Uranium is already in groundwater in 200 east.

The horizontal movement of water in the subsurface is clearly shown in the vadose zone observatory data (south of PUREX).

And, contrary to the belief of some of the technical staff, this horizontal movement is not spreading or lense formation (which might be viewed as retarding waste). It is instead preferential horizontal transport to vertical channels that bypass the soil column and short circuit to the groundwater.

The EIS should in no way be based on such a clearly flawed and inadequate model.

Should DOE proceed despite this evidence, it is incumbent on DOE to do large scale field tests of water and waste movement in the central plateau area to determine which conceptual model is correct. When DOE confirms that SAC is incorrect, it is incumbent on DOE to abandon any decision based upon it.

E-0047/032

SAC can not be used to assess cumulative risk because SAC is still in its early stages of development.

L-0012/002

Most of the alternatives to disposal, transportation and treatment of waste is based on assumptions. You state in different places in this EIS that the amount of waste that will be brought in is uncertain, unknown. That the long-term performance of our waste site remedies and closure techniques are unproven. That your risk modeling tool, the Systems Assessment Capability (SAC), is still very young, emerging; that each human's response to dose or exposure is uncertain. In other words, it all evens out according to your assumptions and modeling, thus the impacts of bringing more waste into Hanford are "minimal" - so benign - not to worry. Even cumulative impacts are painted as "small", but you also state that the SAC risk model has not yet completed the inventory and classification of waste forms.

L-0041/030

The EIS does not adequately deal with the uncertainties in the Systems Assessment Capability (SAC) conceptual model. This document should contain a detailed discussion of the affects of simplifying assumptions and the averaging of parameters in this model.

L-0044/027

Vol. I, Sec. 3.5, App. L. (Re: Comment # 170) Section 3.5 addresses uncertainty in a qualitative manner. Although the SAC addresses uncertainty quantitatively (Section L.2.8), this analysis is limited to the variation in modeled parameters and does not differentiate between uncertainty due to lack of knowledge vs. uncertainty due to natural variation.

L-0052/010

We realize that some risk models such as SAC do not predict major impacts to the river from the 200 Area, but we are also aware that SAC currently does not have an ecological risk module in the composite analysis. Also, the scientific community has not wholeheartedly endorsed the SAC and as we all know, models should only be used as one of the tools to assist with decision-making.

L-0055/022

Although all models have some uncertainty associated with them, the SAC is not a well tested tool. Other techniques such as using Modflow to model the ground water flow may be a better technique. This method is widely accepted in the industry, and has been peer-reviewed quite often. The SAC model has failed to accurately represent known ground water contamination in many locations.

TPO-0002/006

This EIS says that they've used CRCIA, [Columbia River Comprehensive Impact Assessment] I was the chair of the CRCIA team, it does not. It fails miserably.

Impact Evaluation

Response

The System Assessment Capability (SAC) is a set of assessment tools developed by DOE that enables its users to model the movement of contaminants from all waste sites at Hanford, through the vadose zone, through the groundwater, and into the Columbia River (DOE-RL 1999b, c; DOE-RL 2000). The HSW EIS uses the SAC to estimate cumulative impacts of contaminants on human health, ecology, and the local cultures and economy.

SAC, has been designed as a stochastic capability with an option to perform deterministic simulations. It uses the groundwater model of the Hanford Site produced and supported by the Groundwater Monitoring Program. DOE agrees that the one-dimensional vadose zone modeling does not capture the complexity needed to model clastic dikes. The current implementation of the one-dimensional model has been history matched to existing conditions. Currently, the groundwater portion of this model implements a three-dimensional conceptual model of the unconfined aquifer. This model has been inverse calibrated to Hanford Site water table measurements from 1944 to present, and uses knowledge of geohydrologic units and field measurements of hydraulic conductivity to condition the model calibration. Future revisions of the SAC will incorporate inverse calibrated alternate conceptual models of the aquifer. As of August 2003, uncertainty in groundwater contaminant migration and fate is represented by the uncertainty in contaminant mobility as reflected in uncertainties in linear sorption isotherm model parameters (for example, distribution coefficients for various contaminants). The HSW EIS provides a conservative analysis commensurate with the purpose of the HSW EIS, which is to bound and compare the consequences of the alternatives. Volume II Appendix L presents a 10,000 year post-closure assessment that was produced using the SAC.

As part of its development, the System Assessment Capability was reviewed by the DOE Integration Project Expert Panel, an eight (8) member panel that provided broad, independent oversight of many Hanford Groundwater/Vadose Zone Integration Project activities. A review of SAC Rev 0. and related groundwater integration issues at Hanford is summarized in the report "Integration Project Expert Panel - Closeout Report for Panel Meeting of September 26-28, 2001" (Integration Project Expert Panel 2001). The HSW EIS uses an updated version of SAC for cumulative groundwater impacts analysis.

For more details of SAC uncertainties see Bryce et al. (2002).

Comments

E-0043/030, EM-0217/030, EM-0218/030, L-0056/030, LM-0017/030, LM-0018/030

The Public Health prediction methods used by the HSW EIS are not professionally accepted methods. The Emergency Response Planning Guides (ERPGs) used in the HSW EIS were intended to set exposure limits, not predict public health impacts. The ERPGs have never gained any acceptance for prediction of public health impacts. Additionally, ERPG guidelines have been developed for fewer than 100 chemicals. The use of ERPGs in the HSW EIS is scientifically inappropriate and ethically misleading.

Response

Emergency Response Planning Guideline (ERPG) values published by the American Industrial Hygiene Association are widely accepted for emergency planning purposes. The definitions of the various ERPGs state they are “The maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing...” …the given effect. These guides are applicable to nearly all individuals, possibly excluding only that very small percentage of hypersensitive individuals. ERPG values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects as described in the definitions for ERPG 1, ERPG 2, and ERPG 3 as a consequence of exposure to the specific substance.

The ERPG 1 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

The ERPG 2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

The ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing life-threatening health effects.

It is recognized by the committee that human responses do not occur at precise exposure levels but can extend over a wide range of concentrations. The values derived for ERPGs should not be expected to protect everyone but should be applicable to most individuals in the general population. In all populations there are hypersensitive individuals who will show adverse responses at exposure concentrations far below levels where most individuals normally would respond. Furthermore, since these values have been derived as planning and emergency response guidelines, not exposure guidelines, they do not contain the safety factors normally incorporated into exposure guidelines. Instead, they are estimates, by the committee, of the thresholds above which there would be unacceptable likelihood of observing the defined effects. The estimates are based on the available data that are summarized in the documentation. In some cases where the data are limited, the uncertainty of these estimates is large. Users of the ERPG values are encouraged strongly to review carefully the documentation before applying these values.

In developing these ERPGs, human experience has been emphasized to the extent data are available. Since this type of information, however, is rarely available, and when available is only for low level exposures, animal exposure data most frequently forms the basis for these values. The most pertinent information is derived from acute inhalation toxicity studies that have included clinical observations and histopathology. The focus is on the highest levels not showing the effects described by the definitions of the ERPG levels. Next, data from repeat inhalation exposure studies with clinical observations and histopathology are considered. Following these in importance are the basic, typically acute studies where mortality is the major focus. When inhalation toxicity data are either unavailable or limited, data from studies involving other routes of exposure will be considered. More value is given to the more rigorously conducted studies, and data from short-term studies are considered to be more useful in estimating possible effects from a single 1-hr exposure. Finally, if mechanistic or dose-response data are available, these are applied, on a case by case basis, as appears appropriate. It is recognized that there is a range of times that one might consider for these guidelines; however, it was the committee's decision to focus its efforts on only one time period. This decision was based on the availability to toxicology information and a reasonable estimate for an exposure scenario. Users who may choose to extrapolate these values to other time periods are cautioned to review the documentation fully since such extrapolations tend to hold only over very limited time frames, if at all.

DOE has developed Temporary Emergency Exposure Levels (TEELs; see Volume I Section 5.11) for chemicals for which ERPG are not available.

Comments

L-0041/040

For some wastes, colloidal transport is likely. This is particularly true for contaminants in tank wastes contacting soils, as evidenced by the principal investigators reports over the last several years. Colloidal transport must be included in the analyses of contaminant fate and transport.

Response

What has been observed in the vadose zone beneath the Hanford tank farms were the results of leaks of large volumes of tank wastes containing extreme geochemical conditions of pH and salt content. The enhanced migration of complexed cobalt-60 originated from a discharge site in the B-BX-BY WMA that received large amounts of liquid wastes. LLBGs have not received tank wastes nor have they received large volumes of liquid wastes and there is no evidence that similar geochemical conditions persists beneath LLBGs.

Comments

L-0052/007

In addition, the ERWM does not feel confident that current modeling efforts, which simplify the exposure pathway as vertical, with no lateral spreading or preferred pathways, provide a solid basis from which to make firm decisions regarding groundwater contamination. To the ERWM it appears DOE is proposing alternatives which allow not only highly toxic levels of radioactivity in the groundwater far in the future with no long-term stewardship structure in place to ensure safety (Figure 3.16, Volume I), but it appears willing to sacrifice the groundwater in the short-term as well.

Response

For the HSW EIS evaluations, the vadose zone has been modeled as a stratified one-dimensional column because of the large number of solid waste disposal facilities that needed evaluation. A one-dimensional approach yields more conservative results than multi-dimensional models that also consider lateral spreading of infiltration and contaminant transport. Multidimensional modeling of the vadose zone has been performed for some waste sources and types (Mann et al. 1997; Mann et al. 2001) but was not practical in this analysis for the large number of sites in question.

On the north side of the 200 East Area, in the Gable Mountain-Gable Butte Gap, there is evidence of erosional channels that may allow communication between the unconfined and the uppermost basalt-confined aquifer (Graham et al. 1984; Jensen 1987). Evidence that hydraulic intercommunication occurs in the Gable Mountain-Gable Butte Gap area, where erosional windows have been identified, includes: chemical composition of groundwater indicating mixing; presence in the uppermost confined aquifer of chemical species (i.e., nitrate ion) and radioisotopes (e.g., tritium and I-129) that are associated with near-surface waste water disposal; similarity of hydraulic heads in the unconfined and uppermost confined aquifers in the vicinity of the Gable Mountain-Gable Butte Gap where the Elephant Mountain basalt is absent; geologic information from borehole logs and geophysical information indicating an area where the Elephant Mountain basalt (confining layer) is absent, and within this area, locations where the underlying Rattlesnake Ridge interbed (water-bearing unit) and portions of the Pomona basalt (confining layer) are absent. The area where the Elephant Mountain basalt is absent represents an area where increased aquifer intercommunication occurs, unimpeded by a confining layer. Another area where increased leakage may occur is in the vicinity of fault zones. Springs are present in the Rattlesnake Hills along the western boundary of the Sitewide Groundwater Model domain that bring groundwater from the basalt-confined aquifer system to the surface. These springs are found where major thrust faults intersect the ground surface (DOE 1988). This provides evidence that the major thrust faults provide conduits for flow between aquifer systems. Anticlines may also be areas of increased communication because of fracturing. However, there is no direct evidence of intercommunication associated with anticlines other than in the area where erosional windows are also present. Elsewhere on the Hanford Site, the Elephant Mountain basalt provides a substantial impediment to vertical intercommunication between the aquifers owing to its thickness and low vertical hydraulic conductivity, which may range from 1E-8 m/d (3.3E-8 ft/d) to 2.6E-4 m/d (8.5E-4 ft/d). The effectiveness of the Elephant Mountain basalt as a confining layer and impediment to vertical communication between the unconfined and uppermost confined aquifers is evidenced by the hydraulic head difference between the two aquifers and difference in groundwater chemistry. However, the rate of pervasive flow through the confining unit may still be substantial because it takes place over a large area.

Comments

L-0044/063

The response describes transport mechanisms of contaminants evaluated. Section G.1.3.3.1 describes the soil-debris model and states: "The inventory was assumed to be perfectly mixed throughout the source volume during the entire release period assuming perfectly mixed conditions reduced the likelihood that solubility would control the release." If a contaminant inventory (e.g., technetium-99 for which Kd is assumed 0) were spread out into a thin layer (pancake-like) across a huge area (such as the LLBGs), the concentration at the water table (once the technetium-99 is driven through the vadose zone) will be lower than if all the contaminant inventory occurred in a compact or smaller area. A scenario by which contaminant inventory distribution yielding the model's approach is not provided in the description of the model. This approach is not conservative.

Response

For the HSW EIS evaluations, the vadose zone has been modeled as a stratified one-dimensional column because of the large number of solid waste disposal facilities that needed evaluation. A one-dimensional approach yields more conservative results than multi-dimensional models that also consider lateral spreading of infiltration and contaminant transport. Multidimensional modeling of the vadose zone has been performed for some waste sources and types (Mann et al. 1997; Mann et al. 2001) but was not practical in this analysis for the large number of sites in question.

The HSW EIS uses the best available data, computer modeling, assumptions, and related methods to produce estimates of reasonably foreseeable environmental impacts. The modeling approach was consistently applied to each alternative, and it provided information that allowed comparison of the alternatives.

Comments

L-0041/036

The EIS contaminant fate and transport modeling is predicated on one-dimensional vertical modeling that is presumed to be conservative and protective of future users. This assumption must also be field tested in a large-scale field test. The final ROD should include specific language requiring verification of numerical modeling assumptions.

Response

For the HSW EIS evaluations, the vadose zone has been modeled as a stratified one-dimensional column because of the large number of solid waste disposal facilities that needed evaluation. A one-dimensional approach yields more conservative results than multi-dimensional models that also consider lateral spreading of infiltration and contaminant transport. Multidimensional modeling of the vadose zone has been performed for some waste sources and types (Mann et al. 1997; Mann et al. 2001) but was not practical in this analysis for the large number of sites in question.

The Record(s) of Decision will comply with applicable NEPA requirements.

Comments

E-0043/031, EM-0217/031, EM-0218/031, L-0056/031, LM-0017/031, LM-0018/031

Second, in order to measure properly the public health impacts resulting from potential exposures to cancer causing hazardous chemicals and radionuclides, the professionally recognized EPA methodology utilizing cancer potency factors should be used in the HSW EIS. This methodology has been used extensively and is the most widely accepted method of predicting potential cancer impacts by risk assessment professionals and toxicologists. Further, the HSW EIS should consider the Washington Model Toxics Control Act risk standards for radionuclides, and the state and federal anti-degradation standards, when measuring public health impacts.

E-0043/032, EM-0217/032, EM-0218/032, L-0056/032, LM-0017/032, LM-0018/032

Third, to measure public health impacts resulting from potential exposures to disease causing chemicals and radionuclides, the professionally recognized EPA methodology utilizing reference dose values should be used. This is the most extensively used and widely accepted method used by risk assessment professionals and toxicologists.

L-0016/018

The information about the effects of radionuclides on humans is spotty at best. At the very longest we've only been playing with such things for a little more than a hundred years, and large-scale exposures have been more recent and often poorly documented. Drawing conclusions concerning 'safe' exposure levels is premature at best.

L-0041/021

Page F.54, Section F.3.2, line 10-12, describes a two step process for evaluating concentration ratios at the year 2046. Instead, we recommend you just decay the 2046 concentration ratios to the time of interest.

TSE-0027/002

I believe that the Draft EIS is just plain inaccurate and disingenuous. The numbers of people and animals that have been harmed over time must be greatly underestimated. It's like .005 or something like that.

Response

The evaluations in the HSW EIS were prepared using accepted standard methodologies, such as "Federal Guidance Report 13 Cancer Risk Coefficients for Environmental Exposure." DOE and EPA use FRG-13 for radiological risk assessment. EPA also uses FRG-13 and related guidance for chemical exposure health impact analysis in its Integrated Risk Information System (IRIS). See Volume I Section 5.11 and the Volume II appendices for more discussion on methodologies used in the HSW EIS.

Comments

TSE-0040/001

I'm just real curious, there wasn't any mention of it in the EIS that I read, I didn't read the whole thing, but I read a good part of it, that these exposures to radioactive materials and to toxic materials can result decades later in cancer. And, you know, those statistics just don't seem to be at all available. But there wasn't any real discussion about how this happens and how the groundwork is set early in workers' lives.

Response

The evaluations in the HSW EIS were prepared using accepted standard methodologies, such as "Federal Guidance Report 13 Cancer Risk Coefficients for Environmental Exposure." DOE and EPA use FRG-13 for radiological risk assessment. EPA also uses FRG-13 and related guidance for chemical exposure health impact analysis in its Integrated Risk Information System (IRIS). See Volume I Section 5.11 and the Volume II appendices for more discussion on methodologies used in the HSW EIS.

Impact Evaluation

The HSW EIS comparison of human health and safety impacts among the alternatives is expressed in terms of worker dose, dose to the public from atmospheric releases, accidents during the operational period, and long-term impacts via the groundwater pathway in the post-closure period. The risks are expressed in many ways, including probability of latent cancer fatalities. Details of the analyses are provided in Volume I Section 5.11 and Volume II Appendix F.

Comments

L-0055/049

The long-lived mobile radionuclides selected with which to make these estimates were technetium-99 and uranium isotopes using the SAC [System Assessment Capaility]. Other long-lived radionuclides occur in sufficient quantity in various Hanford sources to also be on interest (such as iodine-129). However, the SAC program had not completed the inventory and classification of waste forms in time to integrate these other radionuclides into the present analysis. This analysis does not include the contribution to cumulative impacts of all radionuclides because of the uncertainties in the inventory and modeling approach. For example, if all sources of iodine-129 were to be considered, the cumulative impacts to the groundwater could be greater by a factor of 3.

Response

The evaluations in the HSW EIS were prepared using accepted standard methodologies, such as "Federal Guidance Report 13 Cancer Risk Coefficients for Environmental Exposure." DOE and EPA use FRG-13 for radiological risk assessment. EPA also uses FRG-13 and related guidance for chemical exposure health impact analysis in its Integrated Risk Information System (IRIS). See Volume I Section 5.11 and the Volume II appendices for more discussion on methodologies used in the HSW EIS.

The SAC, as a groundwater modeling capability, is being continuously refined. The initial SAC assessment (Bryce et al. 2002) demonstrated that a relatively small number of input parameters could determine most of the variability in calculated performance measures. SAC has been updated since the initial assessment and, for purposes of the HSW EIS, an additional 25 runs were made for this EIS using the more refined model. It was observed that when the performance measure is human dose, variability with regard to individual behavior and exposure affects uncertainty in the estimated dose more than variability in inventory, release, or environmental transport of the contaminants. Based on this observation, the HSW EIS evaluated several different exposure scenarios to address this uncertainty. Exposure scenarios included: drinking water, resident gardener, resident gardener with sauna/sweat lodge, and industrial worker.

Iodine-129 inventories have been estimated and included in the cumulative groundwater impacts analysis. See Volume I Section 5.14 and Volume II Appendix L.

Comments

L-0055/020

This is a long term project that will also have impacts to the air shed. Several aspects of air quality should have been included. Transportation issues, Dust issues affect the air shed. Haze (Visibility) and PM-2.5 should also be examined in the HSW EI.

Cumulative air quality impact should also be examined. The HSW project will be adding emissions to an air shed that already has numerous point and area sources that are affecting air quality. The environmental impact of area sources and mobile sources of air emissions does not appear to have been addressed in the EIS. Are and mobile sources of air emissions may add significant levels of criteria pollutants to those air emission sources that have been considered.

The EIS fails to recognize, consider and assess the Pollution Prevention Act and DOE's policy on renewable energy with respect to air quality impacts from utilizing alternatives for diesel fuel.

Response

Volume II Appendix E provides information to support the non-radiological air quality impact analysis presented in Volume I Section 5.2. The analysis characterizes the routine emission of non-radiological pollutants by most Hanford Solid Waste Program activities, the atmospheric dispersion of these pollutants, and the maximum air quality impacts to the public. Pollutant sources include mobile sources (such as diesel engines), propane-fired equipment, and fugitive dust sources. Volume I Section 5.8 covers the air quality impacts associated with the transportation of radioactive and hazardous wastes. Volume I Section 5.11 and Volume II Appendix F report on the potential health impacts associated with the emission of chemicals and radionuclides.

The Pollution Prevention Act is discussed in Volume I Section 6.17. DOE's pollution prevention/waste minimization program is discussed in Volume I Section 2.2.5 and Volume II Appendix N. DOE will continue to follow its policies regarding renewable resources. Cumulative air quality impacts are discussed in Volume I Section 5.14. Effects on aesthetic and scenic resources are discussed in Volume I Section 5.12. Incremental impacts from proposed actions on haze and PM-2.5 are expected to be small.

Comments

F-0025/006

The potential reactions must be well studied before the environmental impact can be ascertained. The long term impacts to groundwater, the Columbia River, public health, and the complete ecosystem must be included. Omissions are unacceptable.

Response

Volume II Appendix G describes the analysis used to calculate concentrations of key contaminants that could potentially reach the groundwater from LLBG disposal units. The analysis also assesses the impacts to accessible surface water resources (the Columbia River) from contaminated groundwater. Concentrations of key contaminants are compared to drinking water standards as a benchmark against which water quality may be assessed. The calculations also provide the basis for estimates of potential human health risk and ecological risk for comparison among the alternative groups. Volume II Appendix G also discusses waste forms, release models, and how they were applied in modeling groundwater transport.

Volume II Appendix I provides information about potential impacts to terrestrial and aquatic ecological resources that may result from implementation of HSW EIS alternatives. Potential impacts to terrestrial resources were evaluated in the near term (i.e., during waste management operations and under current conditions). Potential impacts would result primarily from surface disturbances associated with excavation and disposal activities. Potential impacts to Columbia River riparian and aquatic resources could occur in the long term, i.e., up to 10,000 years following the conclusion of waste management operations. These would be primarily the result of the eventual migration of radionuclides and other hazardous chemicals through the vadose zone to groundwater and on to the Columbia River.

The human exposure scenarios described in Volume II Appendix F consider direct and indirect use of the Columbia River water and biota (e.g., swimming, consumption of fish). For those radiological and non-radiological contaminants that will reach the Columbia River bioaccumulation of contaminants and resulting impacts to non-human biota are also expected to be small. See Volume I Sections 5.5 and 5.11, and Volume II Appendix F and Appendix I.

Comments

F-0013/002

Where is the risk analysis regarding unlined soil trenches, cumulative waste analysis, and groundwater monitoring?

THR-0005/005

In addition, an in-depth analysis on the potential risk [has to be done].

Response

Risk analysis is used throughout the HSW EIS. See Volume I Section 5 in the EIS and Volume II Appendices F, G, H, I and L.

Comments

F-0025/004

By doubling the present radioactive waste at Hanford with a mixture of high level, low level, and transuranic waste, there are cumulative risks that need to be evaluated.

F-0030/003

What are the impacts of doubling the current waste?

TPO-0008/002

And this importing of additional waste, what are the hazards and, if any, benefits of adding to the waste storage at Hanford?

TPO-0010/002

We're haggling over the minimum questions. We argue where the trucks will run, how long the method of disposal, like, for example, in terms of interims of 30 to 50 years. I mean, what is that?

What about the future? We talk about limiting the impact. I can't even get my mind around the smallness of what we're talking about.

Response

The HSW EIS evaluates various forecast waste quantities that include only Hanford-generated waste, in addition to varying amounts of offsite waste. This evaluation reflects the uncertainty in waste quantities that Hanford might receive from offsite. The inclusion of a Hanford-only waste volume provides the basis for determining the incremental impacts of offsite waste. See Volume I Section 3.2 for a discussion of the different waste volumes addressed in the HSW EIS. The evaluations of groundwater impacts in Volume I Section 5.14 of the HSW EIS include the impacts of the wastes to be managed within the scope of the HSW EIS NEPA review, as well as the CERCLA wastes disposed in the Hanford ERDF. Analysis indicates that these wastes could be handled without complicating future remediations, or diverting resources or disposal capacity from other Hanford cleanup activities.

Impact Evaluation

The HSW EIS uses the definition of cumulative impact as defined by the CEQ Regulations (40 CFR 1508.7): "Cumulative impact" is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Potential cumulative impacts associated with implementing the HSW EIS alternative groups are summarized in Volume I Section 5.14. Past, current, and future Hanford activities include treatment and disposal of tank waste, CERCLA remediation projects, previously disposed of waste, decontamination and decommissioning of the Hanford production reactors and other facilities, waste in the PUREX tunnels, operation of a commercial LLW disposal facility by U.S. Ecology, and operation of the Columbia Generating Station by Energy Northwest. Cumulative impacts of storage, treatment, and disposal activities for a range of waste volumes are evaluated and expanded in the final HSW EIS. For most resource and potential impact areas, the combined effects from the alternative groups for the Hanford Only, Lower Bound and Upper Bound waste volumes, or for the No Action Alternative for the Hanford Only and Lower Bound waste volumes, when added to the impacts of these other activities, are small.

Comments

E-0041/007

In response to a question about the longevity of asphalt, this is dismissed without answer as irrelevant, since (I'm paraphrasing here) 'nobody will ever dig that deep anyway'—a perilous assumption, and not an answer to the question.

Response

Intruder scenarios and consequences are essentially the same for all alternative groups. The exception would be for the basement excavation scenario in the No Action Alternative, where only the Trenches 31 and 34 containing MLLW are capped. The depth of capping material would be expected to preclude the occurrence of that scenario for those wastes. See Volume I Section 3.4.11 and Volume I Section 5.11.

Comments

E-0043/035, EM-0217/035, EM-0218/035, L-0056/035, LM-0017/035, LM-0018/035

…many Native American populations may by treaty right enter the Hanford Site. Therefore, they are not 'intruders.' Impacts on these specific populations should be analyzed quantitatively separate from the analysis of impacts on 'intruders' and the general public within the Hanford Site vicinity.

L-0041/053

Appendix F needs rationale for choosing parameters for analysis. The final EIS must explain why the Industrial and Resident Gardener exposure scenarios were chosen and what other scenarios were considered. DOE should explain why default values were used for Hanford soil density instead of actual values.

L-0041/054

Exposure scenarios in Appendix F are inconsistent. Resident Gardener is assumed to receive the same dermal soil exposure as an industrial worker (F.37). Resident Gardener scenario includes local game consumption but no Columbia River fish consumption. This inconsistency should be resolved.

L-0044/029

CRD, p. 3.113 (Re: Comment # 182) Three exposure scenarios were evaluated (i.e., industrial, residential gardener, and residential gardener with sweat lodge inhalation), along with several accident and intruder scenarios. Although this is a relatively limited suite of scenarios, in comparison to HSRAM [Hanford Site Risk Assessment Methodology] or CRCIA efforts, the three scenarios may effectively capture the range of risk. At the same time, however, it is surprising that a complete Native American scenario was omitted.

Impact Evaluation

L-0044/037

CRD, pp. 3.92-94 (Re: Comment # 85) It is surprising that a complete Native American scenario was omitted, considering its sensitivity (both in terms of risk and environmental justice issues). Although the comment response primarily addresses fish consumption, there are other exposure factors in the scenario that may lead to increased risks (e.g., Harris and Harper, 1997).

L-0044/038

CRD, pp. 3.94 (Re: Comment # 86) Three exposure scenarios were evaluated (i.e., industrial, residential gardener, and residential gardener with sweat lodge inhalation), along with several accident and intruder scenarios. This is a rather limited suite of scenarios in comparison to HSRAM or CRCIA efforts. For example, exposures to Native Americans were omitted, and children (as a subpopulation with unique exposure factors) were not explicitly modeled.

L-0055/054

The largest uncertainties for the HSW EIS surround the actual volumes of waste that DOE must treat, store, and dispose of and their associated levels of activity. This uncertainty is very critical to be able to get an accurate estimation of the potential impacts to the environment. Without this, the EIS is only guessing and doing a poor job at that. What goes into these sites has a large influence on altering the ground water chemistry and the mobility of the waste types.

Response

The HSW EIS uses two exposure scenarios to evaluate the potential impacts to humans from solid waste management activities: industrial and resident gardener (agricultural). For waterborne pathways, an additional analysis has been performed for the resident gardener scenario to include a sauna/sweat lodge exposure pathway (indicated in the result tables of Volume II Appendix F as the hypothetical resident gardener with sauna/sweat lodge). These scenarios were chosen to represent a range of habits and conditions for potential exposures. The industrial and resident gardener scenarios are based on the recommendations presented in the Hanford Site Risk Assessment Methodology (HSRAM) as adopted by the TPA. These scenarios are based on the concept of reasonable maximum exposure as recommended by EPA for which the most conservative parameter is not always used. The resident gardener with a sauna/sweat lodge scenario also includes exposure to waterborne contamination used in a sweat lodge or sauna. The resident gardener with a sauna/sweat lodge scenario is only applied to waterborne pathways because the airborne pathways do not contribute to the sauna/sweat lodge exposure pathways. See Volume II Appendix F.

Design features built in to the alternatives and potential mitigation measures discussed in Volume I Section 5.18 are developed to protect all people, including children, and the environment. For further information on radiation risk results for children can be found in Volume II Appendix F Section F.1.8.

Within this EIS, an intruder is identified as any individual who inadvertently excavates or drills through a waste site after active institutional controls are assumed, for purposes of analysis, to end.

The "default" values are representative of Hanford soil density values.

An expanded discussion of uncertainties associated with the HSW EIS impact analyses is included in Volume I Section 3.5.

Comments

L-0041/033

Contaminant fate and transport modeling to support the various alternatives does not consider lateral transport of water beneath the proposed surface barriers. Lateral movement in the vadose zone has been monitored and documented beneath the Hanford site. One-dimensional vertical movement should only be used if that can be shown to be conservative when compared to observed fast transport phenomena.

Impact Evaluation

Response

Lateral water movement, as a phenomenon that might affect contaminant transport, has not been evaluated in the HSW EIS. This is attributable to an absence of field observations of natural recharge events causing lateral movement of water under the solid waste burials. It is possible that liquid discharge waste sites, sewer tile fields, and unplanned releases located immediately adjacent to solid waste burial grounds could create higher moisture contents in and above some strata within the vadose zone profile, and that such water could move laterally. However, such events and effects would be local and short term (operational era), relative to the larger scale and longer term risk assessments (thousands of years).

For the SAC, the solid waste burial grounds have been simulated as aggregated solid wastes with a one-dimensional model that did not assume movement of water laterally under the burial grounds. Multidimensional analyses are conducted as part of the Solid Waste Burial Ground Performance Assessments. These analyses are based on a uniform recharge rate over the disposal region, and may project a buildup of moisture in and above some strata in the geohydrologic profile before drainage occurs. The performance assessment analyses do not indicate lateral migration. (Wood et al. 1995, Wood et al. 1996).

For the HSW EIS evaluations, the vadose zone has been modeled as a stratified one-dimensional column because of the large number of solid waste disposal facilities that needed evaluation. A one-dimensional approach yields more conservative results than multi-dimensional models that also consider lateral spreading of infiltration and contaminant transport. Multidimensional modeling of the vadose zone has been performed for some waste sources and types (Mann et al. 1997; Mann et al. 2001) but was not practical in this analysis for the large number of sites in question.

Comments

THR-0021/002

And the other thing that they refuse to assess is the combined effects of other plumes migrating into other plumes. For example, at the Strontium 90 plume at Hanford, which is at N-Area, which Strontium 90, if you are deficient in calcium, your body absorbs it like calcium, so think of fish. This is an extremely contaminated site. There is a sodium plume that is right beside it. Back in the old days, like '94, '93, they talked about the sodium plume eventually migrating into the strontium 90 plume, which would then dissorb it, make the strontium 90 release and go into the river. They refuse to model that.

Response

Sodium does not preferentially desorb strontium due to the fact that strontium, a divalent cation with a low radius of hydration, is above monovalent sodium, with a large radius of hydration, in the lyotropic series.

Comments

E-0043/016, EM-0217/016, EM-0218/016, L-0056/016, LM-0017/016, LM-0018/016

The alternatives should also encompass:

· Mounded soil covering the trenches, which would shed rainwater and create less leachate;
· Alternative cap types that will reduce the risk of human, animal, or plant intrusion;
· Concentration limits for radionuclides;
· Independent regulation of LLW disposal as an alternative;
· Megatrench disposal analysis that covers ILAW
· An alternative that charges generators the long-term, fully burdened costs of storage, treatment, or disposal;
· An alternative that shows the unlined burial grounds as closed.
· The storage and disposal of TRU waste in the event that the Waste Isolation Pilot Plant (WIPP) does not accept waste within the scope of the HSW EIS or does not open by 2005.

Response

Mounding soil is addressed in Volume I Section 5.18. The cap analyzed in the HSW EIS is designed to reduce the risk of human, animal, and plant intrusion. Concentration limits are set forth in the HSSWAC discussed in Volume I Section 2.1.1. LLW is regulated under the applicable requirements of the Atomic Energy Act, CERCLA, and other laws. The HSW EIS includes alternatives for the disposal of ILAW in megatrenches (see Volume I Section 3.1). All alternatives, except the No Action Alternative, include closure of unlined trenches in the LLBGs. DOE has already decided to send TRU waste to WIPP for disposal. Sufficient storage currently exists at Hanford should WIPP not be able to accept certain TRU waste streams before 2005.

Charging DOE waste generators higher disposal costs is not expected to reduce the amount of waste generated by DOE sites or to increase the amount of waste reduction already occurring under the DOE pollution prevention and waste minimization program. The Pollution Prevention Act, Section 6002 of RCRA and several executive orders were enacted, in part, because it was recognized that (1) government organizations should make efforts to minimize the amount of waste they generate and (2) economic incentives generally do not work for government entities. For waste being disposed of at Hanford, the waste generator and the disposal facility are both part of the same government organization, the DOE. Although private companies can collect money today for work to be performed in later years, government organizations like DOE are precluded from collecting money to cover future costs (such as closure costs and long-term monitoring costs) without specific congressional approval.

The recent "Report to Congress - The Cost of Waste Disposal: Life Cycle Cost Analysis of Disposal of Department of Energy Low-Level Radioactive Waste at Federal and Commercial Facilities" (DOE 2002d) explains that waste disposal decisions should be made based on the total life-cycle cost of waste disposal. These decisions need to consider the costs for treatment, inspection and verification, disposal, closure, and long-term monitoring. The DOE pollution prevention and waste minimization program already requires waste disposal decisions to be made based on life-cycle costs and other factors. See Volume I Section 2.2.5 for a discussion of the DOE pollution prevention/waste minimization program.

Comments

TSE-0027/003

I do not think all the truth about this matter [cancer incidence in Richland area] is in this EIS. How do we get it in there?

Response

Latent cancer fatalities are discussed in Volume I Section 5.11 and Volume II Appendix F.

Comments

L-0061/001

The revised DEIS includes additional alternatives as compared to your earlier DEIS; however, we recommend expanding the analysis of environmental effects to take into account non-radiological contaminants, include site-specific toxicological information, and more thoroughly address potential effects to biota.

L-0061/002

The Ecological Resources and Environmental Consequences sections should be revised to evaluate all anticipated contaminants associated with the various wastes. For instance, impacts to Columbia River aquatic and riparian resources were limited to key radionuclides (page I.27). All radiological and non-radiological hazardous waste should be identified and evaluated for exposure, effects, and risk. The risk analysis should include an evaluation of cumulative, additive, synergistic, and antagonistic effects of all potential contaminants in order to ascertain appropriate clean-up levels. We [United States Department of the Interior] also strongly suggest that site-specific toxicological data for local species be included in any risk assessments so effect levels can be customized to local conditions. We realize that many uncertainties exist for the Hanford site, but identifying which contaminants have the potential to be released and determining effect levels to biota are necessary to conduct a quality ecological risk assessment. We recommend that additional data be collected and that you coordinate with the Hanford Natural Resource Trustee Council on the evaluation of risk to ecological receptors.

Response

The LLBGs contain over 100 radioactive and non-radioactive constituents that potentially could impact groundwater. Screening of these constituents considered a number of aspects that included (1) their potential for dose or risk, (2) their decay or degradation rates, (3) their estimated inventories, and (4) their relative mobility in the subsurface system within a 10,000-year period of analysis. Establishing the relative mobility of each contaminant, they were grouped based on their mobility in the vadose zone and underlying unconfined aquifer. Contaminant groupings were used, rather than the individual mobility of each contaminant, primarily because of the uncertainty involved in determining the mobility of individual constituents. The waste constituents were grouped according to estimated or assumed Kd of each constituent.

Based on an assumed infiltration rate and estimated levels of sorption and associated retardation, the estimated travel times of a number of constituents through the thick vadose zone to the unconfined aquifer beneath the LLBGs were calculated well beyond the 10,000-year analysis. Thus, these constituents were eliminated from further consideration. Of the remaining constituents, technetium-99, iodine-129, carbon-14, and uranium isotopes were considered of sufficient quantity and mobility to warrant detailed analysis of groundwater impacts. Selenium and chlorine, while mobile, were screened out because their total inventories were less than 0.01 Ci. Tritium and cesium were not evaluated because of their relatively short half-lives. Plutonium was screened out because of its lack of mobility.

The approach taken in the HSW EIS is consistent with the methods, characteristics, and controls associated with a composite analysis as described by the Columbia River Comprehensive Impact Assessment (CRCIA) team. The analysis modules included in the SAC parallel those identified by CRCIA and were developed through work group meetings that included regulator and stakeholder participation. Several key modules were adopted directly from the CRCIA including the module used to calculate human health impacts (the HUMAN code) and the module used to calculate impacts to ecological species (the ECEM code).

Discussion of the synergistic transport effects among organic and inorganic contaminants is provided in Volume I Section 5.3 and Volume II Appendix G. To establish the relative mobility of each contaminant, they were grouped based on their mobility in the vadose zone and underlying unconfined aquifer. Contaminant groupings were used, rather than the individual mobility of each contaminant, primarily because of the uncertainty involved in determining the mobility of individual constituents. The groups were selected based on relatively narrow ranges of mobility, and constituents were placed in the more mobile group when there was uncertainty concerning which group they should be placed in. Some of the constituents, such as iodine and technetium, would move at the rate of water whether in the vadose zone or underlying groundwater. The movement of other constituents in water, such as americium and cesium, would be slowed or retarded by the process of sorption onto soil and rock.

The human exposure scenarios described in Volume II Appendix F consider direct and indirect use of the Columbia River water and biota (e.g., swimming, consumption of fish). For those radiological and non-radiological contaminants that will reach the Columbia River bioaccumulation of contaminants and resulting impacts to non-human biota are also expected to be small. See Volume I Sections 5.5 and 5.11, and Volume II Appendix F and Appendix I.